[0072] Binding complex formation can also be detected electrically, such as by current measurement (where there is oxidation and reduction or free electron production), FET or potential measurement (where there is net or local charge changes), or by CHEM-FET, surface plasmon resonance, mass spectroscopy, interferometry, or radioactivity. These methods of detection are merely non-limiting examples of the many possible methods of detecting the presence of a binding complex or signal particle in the detection zone of the fluidic device of the invention.

[0073] The use of fluidic devices to conduct biomedical assays has many significant advantages. First, because the volume of fluids within the fluidic zones is very small, usually several nano-liters, the amount of reagents and analytes required for the assays is quite small. This is especially significant for expensive reagents. The fabrications techniques used to construct these fluidic devices, discussed in more details herein, are relatively inexpensive and are very amenable both to highly elaborated, multiplexed devices and also to mass production, such as in an integrated circuit die. In manners similar to that for microelectronics, fluidic technologies also enable the fabrication of highly integrated devices for performing different functions on the same substrate chip. Embodiments of the invention helps create integrated, portable clinical diagnostic devices for home and bedside use, thereby eliminating time consuming laboratory analysis procedures. Additionally, certain embodiments of the invention are self-contained such that liquid does not flow through the fluidic zones, thereby eliminating the need for flow controllers. A self-contained fluidic network can also comprise prestored reagents, meaning during a test, no addition reagents need to be added except for the sample, and water or buffer. In such embodiments, the magnetic particles and any molecules bound to the magnetic particles are moved through the liquid contained within the fluidic zones by activating the magnetic microcoils, and are not moved by the flow of the liquid. Typically in these embodiments, the fluid is present in the fluidic zones to act as a suspending agent. Other embodiments of the invention comprise a flow controller for coordinating liquid flow through the fluidic zones of the device. In such embodiments, the magnetic particles and any molecules bound to the magnetic particles are moved through the fluidic zones by activating the magnetic microcoils and/or also can be moved by activating the flow controller to move the liquid itself.

[0074] As used herein, "magnetic," "magnetic effect," and "magnetism" refer to the phenomena by which one material exert an attractive or repulsive force on another material. Although theoretically all materials are influenced to one degree or another by magnetic effect, those skilled in the art understand that magnetic effect or magnetism is only recognized for its detectability under the specific circumstance.

[0075] As used herein, a "permanent magnet" is a material that has a magnetic field without relying upon outside influences. Due to their unpaired electron spins, some metals are magnetic when found in their natural states, as ores. These include iron ore (magnetite or lodestone), cobalt, and nickel. A "paramagnetic material" refers to a material that attracts and repels like normal magnets when subject to a magnetic field. Paramagnetic materials include aluminum, barium, platinum, and magnesium. A "ferromagnetic material" is a material that can exhibit a spontaneous magnetization. Ferromagnetism is one of the strongest forms of magnetism and is the basis for all permanent magnets. Ferromagnetic materials include iron, nickel, and cobalt. A "superparamagnetic material" is a magnetic material that exhibits a behavior similar to that of a paramagnetic material at temperatures below the Curie or the Neel temperature.

[0076] An "electromagnet" is a type of magnet in which the magnetic field is produced by a flow of electric current. The magnetic field disappears when the current ceases. A simple type of electromagnet is a coiled piece of wire that is electrically connected. An advantage of an electromagnet is that the magnetic field can be rapidly manipulated over a wide range by controlling the electric current. In the embodiments of the invention, ferromagnetic or non-magnetic materials are used to form the electromagnets.

[0077] An "array," "macroarray" or "microarray" is an intentionally created collection of substances, such as molecules, openings, microcoils, detectors and/or sensors, attached to or fabricated on a substrate or solid surface, such as glass, plastic, silicon chip or other material forming an array. The arrays can be used to measure the expression levels of large numbers, e.g., tens, thousands or millions, of reactions or combinations simultaneously. An array may also contain a small number of substances, e.g., one, a few or a dozen. The substances in the array can be identical or different from each other. The array can assume a variety of formats, e.g., libraries of soluble molecules; libraries of compounds tethered to resin beads, silica chips, or other solid supports. The array could either be a macroarray or a microarray, depending on the size of the pads on the array. A macroarray generally contains pad sizes of about 300 microns or larger and can be easily imaged by gel and blot scanners. A microarray would generally contain pad sizes of less than 300 microns.

[0078] An array of magnetic microcoils is a collection of microcoils fabricated on a substrate, such as silicon, glass, or polymeric substrate. Each of the microcoils may be associated with or functionally coupled to the fluidic device containing fluidic zones, across which the microcoil is capable of generating a magnetic field as part of a biomedical assay. The fluidic zones may be a space for holding a liquid sample and/or a surface for immobilizing certain molecules, such as DNAs and proteins. The microcoil arrays may be a microarray or a macroarray depending on the sizes or the microcoils and the associated sample spaces. In one embodiment, the microcoil array is programmably activatable such that individual members or groups of the array turn on and off in a coordinated manner in order to move the magnetic particles (and any compounds or molecules attached to the magnetic particles) from one fluidic zone to another fluidic zone. As used herein, "move" refers to changing the position of the magnetic particle, and includes concentrating and dispersing the particles as well as re-locating the particles within a fluidic zone and/or from one fluidic zone to another fluidic zone.

[0079] A DNA microarray is a collection of microscopic DNA spots attached to a solid surface forming an array. DNA microarrays can be used to measure the expression levels of large numbers of genes simultaneously. In a DNA microarray, the affixed DNA segments are known as probes, thousands of which can be used in a single DNA microarray. Measuring gene expression using microarrays is relevant to many areas of biology and medicine, such as studying treatments, disease and developmental stages.

[0080] "Solid support" and "support" refer to a material or group of materials having a rigid or semi-rigid surface or surfaces. In some aspects, at least one surface of the solid